Ilan GOLECKI, Ph.D.

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PRESENT AFFILIATION

1987 - present: Honeywell International Inc. - formerly AlliedSignal Inc., Corporate Research and Technology, 101 Columbia Road, Morristown, NJ 07962. Phone 973-455-4938, FAX 973-455-4339, ilan.golecki@honeywell.com.

Project Leader and Principal Scientist; promoted 1993; recipient of several achievement awards.

I manage multiple product-specific projects, funded by the corporation and by the U.S. Government, spanning broad technology areas in**:**

- Development of **wide range of amorphous, polycrystalline and epitaxial single-crystalline thin-films and coatings by plasma-assisted chemical vapor deposition for oxidation protection of Carbon** and other fibers in composites, **low-friction/low-wear machinery**, packaging and **high-temperature electro-optics**, e.g.: **SiC, SiO_xC_y, BN, TiN**.
- Development of advanced, **thin-film, current-carrying metallizations and heaters fabricated by ion-assisted physical evaporation** for high-temperature sensor applications.
- **Rapid densification of Carbon-Carbon** and other porous fiber-matrix composites by chemical vapor infiltration for heat exchangers, fuel cells, aircraft brakes and other structural applications.

PREVIOUS EMPLOYMENT

1979 - 86: Rockwell International Corporation, Defense Electronics Operations, Microelectronics Research and Development Center, Thousand Oaks and Anaheim, CA.

Project Leader and Member of the Technical Staff; promoted twice.

- **Development of novel Silicon-On-Insulator materials and technologies** for radiation-hard circuits by **chemical vapor deposition and ion implantation** (1979-1985).
- **Molecular beam epitaxy of GaAs and $Al_xGa_{1-x}As$** for high-speed circuits (1985-1986).

1979 - 86: California Institute of Technology, Department of Applied Physics, Pasadena, CA.

Visiting Associate Faculty Member in Professor Marc-A. Nicolet's group.

- **Rutherford backscattering and channeling analysis of thin films for microelectronics.**

1978 - 79: California Institute of Technology, Dept. of Applied Physics, Pasadena, CA.

Post-Doctoral Research Fellow in Professors James W. Mayer's and Marc-A. Nicolet's group.

- **Ion beam modification and characterization of Si, Si-On-Sapphire and GaAs.**
- **Transient annealing of Si, Ge/Si and GaAs by pulsed laser, pulsed electron beam and solar energy**.

EDUCATION

Ph.D. (Physics), 1978, University of Neuchâtel, Neuchâtel, Switzerland.

Surface disorder of single-crystal ice (H_2O) between -191°C and -2°C, studied by 100 keV proton channeling (adviser: Professor Claude Jaccard).

M.Sc. (Physics), 1974, Technion - Israel Institute of Technology, Haifa, Israel.

An interferometric gas analysis system for the measurement of changes in stoichiometry in metal oxides (adviser: Professor David S. Tannhauser).

B.Sc. Cum Laude (Physics), 1970, Technion - Israel Institute of Technology, Haifa, Israel.

Solid State Orientation. Graduated 3rd in class of 30.

PUBLICATIONS AND HONORS

- **Book editor.**
- **Authored invited chapter in a reference book and other invited review papers.**
- **67 papers in refereed journals.**
- **10 U.S. and international patents.**
- **Biography included in "Who's Who in Science and Engineering" (1994-1995, 2nd ed.)**

CITIZENSHIP STATUS: U.S. Citizen.

TECHNICAL MANAGEMENT AND PERSONNEL SUPERVISION

- **I manage multiple Research and Development projects spanning broad technology areas and provide leadership** to multiple teams of senior Ph.D., M.S., B.S. and other professionals in a Six Sigma/Total Quality environment at Honeywell International Inc. (formerly AlliedSignal Inc.) from 1987 to the present and previously at Rockwell International Corporation (1979-86). The projects which I lead are **funded both by the corporation and by the U.S. Government.**

  My responsibilities include:
  - Conceiving new ideas for realistic product-focused technologies, aligned with several sectors, strategic business units and enterprises within the corporation.
  - Writing project proposals and obtaining adequate funding.
  - Staffing project teams with full-time and contract employees.
  - Delivering on technical milestones within promised time and budget constraints.
  - Managing short- and long-term finances.
  - Specifying and ordering capital equipment and supplies.
  - Designing and setting up laboratories for specific technologies and projects.
  - Carrying out experimental work and data analysis using a broad spectrum of complex pieces of equipment and statistical methods.
  - Generating short- and long-term reports.
  - Maintaining frequent communication channels with customers, team members and management.
  - Writing invention disclosures and patent applications.
  - Publishing in national and international journals and conferences.

- Examples of **Industrial R&D Projects I Manage(d) since 1979:**
  - **Development of oxidation-protective coatings for Carbon-Carbon composites**.
  - **Rapid densification of Carbon-Carbon composites by chemical vapor infiltration** for structural aerospace applications, e.g. brakes and thermal management components.
  - **Growth of BN layers by plasma-enhanced CVD** for refractory tribological applications.
  - **Growth of TiN layers by CVD on internal surfaces** for low-wear rotating components.
  - **Development of thin-film current-carrying metallizations by ion-assisted physical evaporation** for high-temperature sensor applications.
  - **Development of thin-film heaters by reactive physical vapor deposition** for high-temperature sensor applications.
  - **Growth of epitaxial single-crystalline SiC layers with desirable properties** by novel plasma-enhanced chemical vapor deposition (CVD) for high-temperature electronics and electro-optics.
  - **Improvement of crystalline quality of epitaxial Silicon-On-Sapphire layers** through ion-implantation-induced amorphization and recrystallization, and use of such layers in the fabrication of high-speed electronic devices with improved performance.
  - **Development of four low-pressure and atmospheric-pressure chemical vapor deposition and infiltration reactors**, including ultra-high-purity cold-wall and hot-wall reactors, plasma CVD, rapid thermal CVD, thermal-gradient and isothermal CVI, using resistive, inductive and lamp substrate heating.

- **Principal Investigator of three Department of Defense research contracts** of which I authored the technical proposals at Honeywell International Inc. - formerly AlliedSignal Inc. (1999 - present) and at Rockwell International Corporation (1981-83).
  - Funded by Air Force Materials Laboratory, AFRL, Wright-Patterson AFB, OH, in 1999 to develop **advanced oxidation-protective methods and coatings for Carbon-Carbon composites for extended use to 650°C**.
  - Funded by Air Force Materials Laboratory, AFWAL, Wright-Patterson AFB, OH; program resulted in the **development of a new Silicon-On-Insulator technology, Si-On-SiO_2-On-Cubic-Zirconia**.
  - Funded by the Army, ERADCOM, Ft. Monmouth, NJ; program resulted in a **patent in recrystallized Si-On-Sapphire technology**.

GREEN BELT - SIX SIGMA/TOTAL QUALITY

- Participated in an **official Green Belt certification course** at Honeywell International Inc.

AREAS OF RESEARCH EXPERTISE AND PUBLICATIONS (See attached publications list.)

- Edited **book on High-Temperature Electronics.**
- Authored **invited chapter in a book on Carbon Fiber Composites.**
- Authored **four invited review papers in refereed journals.**
- Authored total of **sixty-seven publications in refereed journals.**
- Delivered **three invited conference presentations.**
- Delivered total of **sixty-eight conference presentations.**
- Authored **ten U.S. and international patents**; others pending.
- **Textbooks** on fabrication of **fiber-matrix composites** and on **vacuum science and technology** in preparation.

- **Rapid densification of porous Carbon-Carbon composites for aerospace applications by novel chemical vapor infiltration techniques** [1991-present].

- **Oxidation protection of C-C composites under different temperature-time regimes** [1995-present].

- **Growth of refractory thin films** (single-crystalline **SiC, SiO_xC_y, Si_3N_4, SiO_2, BN, TiN**) for electro-optical, tribological and **oxidation-protective applications** by novel, **plasma-assisted, low-pressure and atmospheric-pressure chemical vapor deposition** techniques [1990-present].

- **Deposition of high-electrical conductivity metal films with controlled stress by ion-assisted physical evaporation** for high-temperature sensor and other applications [1996-2000].

- **Deposition of thin-film compound resistive heaters by reactive physical evaporation** [1998-2000].

- **Development of four low- and atmospheric-pressure chemical vapor deposition and infiltration reactors**, including ultra-high-purity cold-wall and hot-wall reactors, plasma CVD, rapid thermal CVD, thermal-gradient and isothermal CVI, using resistive and inductive substrate heating [1987-present].

- **Design and assembly of complex vacuum systems for synthesis of materials, e.g., chemical vapor deposition, physical evaporation, ion implantation** [1987-present].

- **Design and assembly of complex vacuum systems for analytical characterization, e.g., Rutherford backscattering and ion channeling, gas-phase optical refractive index measurements** [1971-present].

- **Design and assembly of complex systems for electrical measurements, precise temperature control of complex enclosures and other applications** [1971-present].

- **Applications of ion beams for the characterization and modification** of thin films and bulk surfaces [1974-87, 1996-present]:
  - **Ion-beam enhanced deposition (IBAD) of elemental and compound metallic and other films** for electronic devices [1996-present].
  - **Rutherford backscattering and ion channeling spectrometry** for non-destructive depth profiling of bulk composition, concentration of heavy impurities and lattice crystallinity, with a depth resolution of 4-20 nm and an accessible depth of 2 μm [1974-87].
  - **Elimination of planar crystallographic defects in Si-On-Sapphire** thin films by Si ion implantation, amorphization and solid-phase epitaxial regrowth [1978-85].
  - **Ion-beam induced epitaxial regrowth of Si - co-discoverer of the effect** [1978-79].
  - Formation of **chemical compounds by very-high-dose ion implantation**, e.g. **SiC** in Si and Si-On-Sapphire by carbon ion implantation [1984-85].

- **Lattice disordering in single-crystalline insulators**, e.g. ice, **due to electronic excitation** deposited by fast, light ions, e.g. 100 keV protons [1974-78].
- Study of the **surface of single-crystalline ice near the melting point by ion channeling** [1974-78].
- **Development of a unique apparatus for performing ion channeling measurements in the presence of vapors up to 20 Torr** [1974-77].

- **Vacuum physics and mass spectrometry** [1971-present].

- **Molecular beam epitaxial growth and characterization of GaAs and $Al_xGa_{1-x}As$ thin films** deposited on GaAs substrates [1985-86].

- **Epitaxial growth of Si thin films** on sapphire and cubic zirconia substrates by atmospheric pressure chemical vapor deposition, processing and characterization of Si thin films [1978-85].

- **Transient annealing of semiconductors** (Si, Si/Ge, Si-On-Sapphire, GaAs) **by pulsed laser, cw laser, pulsed electron beam, solar energy and quartz halogen lamp sources** [1978-81].

- **Physics of ice** [1974-78].

- **Physics of non-stoichiometric transition-metal oxides and development of a unique, high-sensitivity optical apparatus for measuring changes in their stoichiometry** [1971-74].

- **Precision optical interferometry** [1971-74].

- **Neutron physics** [1974-78].

MEMBERSHIP IN PROFESSIONAL ASSOCIATIONS

* American Carbon Society	* American Ceramic Society	* American Vacuum Society
* Böhmische Physical Society	* Electrochemical Society	* Materials Research Society
* IEEE (The Institute of Electrical and Electronics Engineers)		* Society of Vacuum Coaters

HONORS AND AWARDS

- **Biography appears in "Who's Who in Science and Engineering, 1994-1995"** (Marquis: 2nd ed., 1994) and "**Who's Who in the World, 1995**" (Marquis: 12th ed., 1994), inclusion in which is limited to those individuals "**who have demonstrated outstanding achievement in their own fields of endeavor and who have, thereby, contributed significantly to the betterment of contemporary society.".**

- **I have written and delivered an invited review chapter in a reference book and invited review papers in prestigious scientific international journals and conferences.**

- **My publications have been cited numerous times**, including in the following books:
  1. "Physics of Ice", V.F. Petrenko and R.W. Whitworth (Oxford University Press, 1999).
  2. "Carbon Reinforcements and Carbon/Carbon Composites", E. Fitzer and L.M. Manocha (Springer Verlag: Berlin, 1998).
  3. "Silicon-on-Insulator Technology: Materials to VLSI", J-P. Colinge (Kluwer Academic, 1991).
  4. "Ion Implantation and Beam Processing", J.S. Williams and J.M. Poate, eds. (Academic Press, 1984).
  5. "Ion Implantation: Science and Technology", J.F. Ziegler, ed. (Academic Press, 1984).
  6. "Materials Analysis by Ion Channeling: Submicron Crystallography", L.C. Feldman, J.W. Mayer and S.T. Picraux (Academic Press, 1982).

- Membership in the Böhmische Physical Society was conferred "**for fundamental contributions to the understanding of channeling in ice crystals**" (1979).

- **B.Sc.** degree in **Physics** was earned **Cum Laude** (Technion - Israel Institute of Technology, 1970). I finished 3rd in my class of 30.

CONFERENCE ORGANIZATION

- Conceived, organized and co-chaired the 1998 Engineering Foundation conference on **High-Temperature Electronic Materials,** Devices and Sensors, February 1998, San Diego, CA. Edited the Conference Proceedings (published by IEEE, 1998).
- Organized and co-chaired the Session on **Chemical Vapor Infiltration** and Interfacial Coatings at the Fourteenth International Conference on Chemical Vapor Deposition, The 192nd Meeting of the Electrochemical Society, Paris, France, September 1997.
- Organized and chaired the Session on **Silicon-On-Insulator** Technologies at the January 1986 SPIE Conference on Advanced Processing and Characterization of Semiconductors, Los Angeles, CA.

PUBLIC SPEAKING EXPERIENCE

- **Sixty-five scientific and technical papers** presented in U.S. and international conferences since 1974.
- **Technology presentation to the Chief Executive Officer** (Mr. Lawrence Bossidy) and the Technical Board of Directors of **AlliedSignal Inc.** (1997).
- Numerous in-person, videoconference and teleconference presentations of project progress reports to upper management and to funding customers at Honeywell International Inc. - formerly AlliedSignal Inc. (1987 - present) and at Rockwell International Corporation (1979-1986).
- Periodic in-person and teleconference presentations of project progress reports to the U.S. Air Force and other U.S. Government funding agencies (1981 - present).
- Numerous project proposal presentations to corporate, U.S. Government and other funding bodies (1974-present).

TEACHING AND MENTORING EXPERIENCE

- **Honeywell International Inc. (formerly AlliedSignal Inc.), 1987-present.**
  Rockwell International Inc., 1979-1986.
  - **I provide leadership and individual mentoring** to a large number of personnel at the senior Ph.D. level, junior Ph.D., M.S., B.S. and other professional levels in a Six Sigma/Total Quality environment.

- **California Institute of Technology: Guest lecturer, Applied Physics Dept., 1984.**
  - Si-On-Sapphire technology in Prof. M-A. Nicolet's graduate course on semiconductors.

- **University of Neuchâtel: Senior Teaching Instructor, Physics Dept., 1974-78.**
  - Supervision of Diplôme (equivalent to B.Sc./M.Sc.) physics projects, e.g. neutron spectroscopy of Californium-252.
  - Development of advanced laboratory experiments for junior and senior level physics students, e.g. mass spectrometry and vacuum science.
  - Development of physics classroom demonstrations, e.g. optics, nuclear physics.

- **Technion - Israel Institute of Technology: Teaching Assistant, Physics Dept., 1971-74.**
  - Development of advanced laboratory projects for gifted freshman students, e.g. normal modes phenomena, mechanical parametric amplification.
  - Supervision of freshman and sophomore physics laboratories.
  - Physics class recitations at the level of the Berkeley Physics Course; preparation and grading of examinations.

REFEREEING

- **Regular refereeing of scientific articles since 1979 for the Journal of Applied Physics and Applied Physics Letters. Regular refereeing of scientific articles for Thin Solid Films and the Review of Scientific Instruments.** Refereeing of scientific articles for The Physical Review, The Journal of Crystal Growth, The Journal of the Electrochemical Society, Metallurgical and Materials Transactions, IEEE Electron Device Letters, Carbon, and conference proceedings of the American Ceramic Society, the Electrochemical Society, the IEEE, the Materials Research Society and SPIE.

- Refereeing of research proposals, e.g. for the National Research Council.
- Refereeing of software programs for the Journal of Minerals, Metals and Materials Society - JOM.

COMPUTER PROFICIENCY

- **I am a published reviewer of scientific commercial software** programs for the Journal of Minerals, Metals and Materials Society - JOM (TMS).
- I am an experienced user of IBM-compatible PC's in networked office, laboratory and home environments for word processing, technical drawing, presentation graphics, data analysis, project management, data acquisition and equipment control. I am a regular user of major software applications run under MS-Windows (and previously under MS-DOS), such as Microsoft Word, Microsoft Excel, Microsoft Powerpoint, Microsoft Project, Microsoft Access, Microsoft Outlook and Mail, Project Scheduler, Minitab, WordPerfect, SigmaPlot, SigmaScan, Co-Draw, and Netscape Navigator.
- I have written computer programs for analysis of Rutherford backscattering spectra.

LANGUAGE PROFICIENCY

English, French, Hebrew: Thorough knowledge.
German, Rumanian: Good working knowledge.

I am an experienced translator of scientific and technical documents.

OTHER PERSONAL DATA

Birth Place: Haifa, Israel.